RECOGNITION OF EMERGENCY AND NON-EMERGENCY LIGHT USING MATROX AND VB6

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ABSTRACT

In a daily life there is always a problem to an emergency vehicle such as ambulance, patrol car and fire-fighter to pass through traffic light because it was red and it's disturbing the drive. A camera system that consists of camera as sensor and some other parts that detect an emergency vehicle could solve the problem from blocked by another vehicle. When the camera that is placed at a certain distance from the traffic light detects an emergency vehicle it would sent a data and it will start the system, then it would activate the traffic light to change to green until the emergency vehicle pass through. This project would focus on developing the software for image processing of emergency light. The captured image will be analyzed using blob analysis to identify connection regions of pixel within the image. The result will be displayed on computer screen to indicate the processed image is emergency light or non-emergency light. This project would use a Visual Basic 6 and Matrox where the image will be process and analyze between emergency and non-emergency light.

CHAPTER 1

INTRODUCTION

1.1 Introduction

In the daily life we always see that there is always a problem to an emergency vehicle such as ambulance, patrol car and fire-fighter to pass through traffic light because it was red and it's disturbing the drive. This situation is often happen because lack of cooperation from civilian, sometimes driver do not had an experience of this situation so they will waited the traffic light to turn green. There is also a conflict with driver from another traffic light where when emergency light past through traffic light on red condition the car from other traffic light did not notice the emergency vehicle and it will cause accidence. The situation can cause a death if the situation appeared. The top priority of this project is to make sure that emergency vehicle past through a traffic light smoothly and safely.

To achieve this target, camera system that consists of camera, frame grabber, computer and hardware to activate the traffic light could solve the problem from blocked by another vehicle. A camera at a certain distance is use as a sensor to take an image in a real time where it needs to use a frame grabber to process the real time image. From the frame grabber image will be loaded to computer where all processing of image will be done, result of image processing will be display by using Visual Basic 6 where GUI is implement in this project. After the result is display a software will activated the hardware to change the traffic light to green until the

emergency vehicle past through. Then the traffic light will operate in a normalized operation.

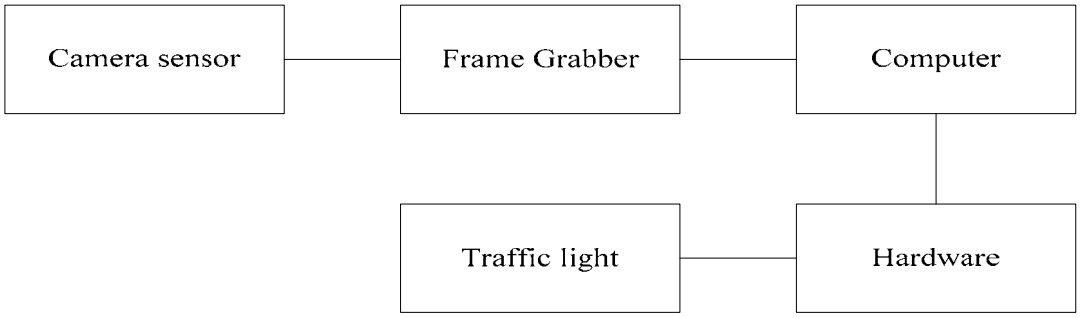


Figure 1.1: Block Diagram of Camera System

1.2 Problem statement

In this project there are some main problems that must inquire, which is will be used to developing the project. The questioning problem is show below:-

i. How the image will be taken?
ii. How to process the image?
iii. What is required software to process the image taken?
iv. What the best method to analyze image?

1.3 Research Objective

Research of this project must take account concerning list below: -

i. To recognize suitable technique to captured image.
ii. To recognize method of process the image
iii. To recognize suitable software to process the captured image.
iv. To identify technique to analyze image.

1.4 Significance Of study (Main Objectives)

The main objective of this project is:

i. To study on image processing using Visual Basic 6 (VB6) and Matrox. It is because to analyze and process the image will perform by using Visual Basic 6 and Matrox (MIL). So it is needed to familiarize with the software, where it will help in developing it.

ii. To develop software that can determine between emergency light and non-emergency light, where it can be used as an application to solve problem regarding traffic blocking the emergency vehicle when there is an emergency. The emergency light of emergency vehicle will be analyzed by the refraction color of the emergency light.

1.5 Scope of work

This project would focus on the image processing of police petrol car emergency light for the software development. The result would be displayed on computer screen to indicate the processed image is emergency light or non-emergency light. This project would use a Visual Basic 6 and Matrox Imaging Library 7 (MIL) to process and analyze the capture image between emergency and non-emergency light.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter will summarize the content of the paper, report and article that were studied related to the project. The basic concept is illustrated in this chapter.

2.2 Visual Basic

Visual Basic is an application that uses to create a graphical user interface (GUI), where ActiveX control is one of the applications in Visual Basic. The form is created by using drag and drop techniques, the control can be place in the form by drag the control into the toolbox. By inserting code in command button control the program can automatically translate the case of the text being entered, or even prevent certain characters from being inserted [1].

VB presents a 3-step approach for creating programs:

i. Design the appearance of your application.
ii. Assign property settings to the objects of your program.
iii. Write the code to direct specific tasks at runtime.

2.3 Matrox imaging library (MIL)

The Matrox imaging library (MIL) is a hardware-independent library divided into different modules based on functionality. Where is has lot of function of image processing such as blob analysis, OCR, pattern matching and lot more. Matrox imaging library is an extended toolbox for Visual basic where the command language for Matrox is Visual Basic and Visual C++ [2].

2.4 Image Processing

Image processing is form of information processing from the image, there a various image processing operation [3]:

i. Combination of two or more images
ii. Image editing and digital retouching
iii. Image restoration to increase the quality of a digital image
iv. Segmentation of the image into regions

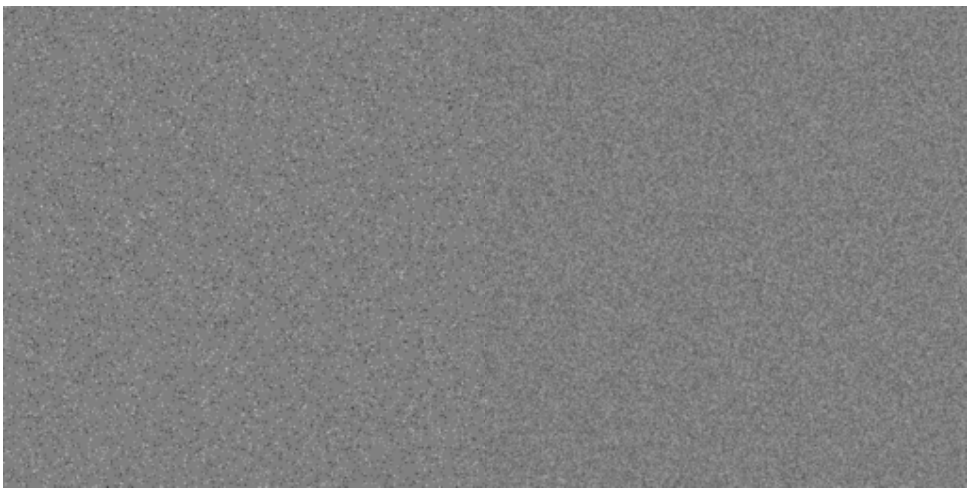
2.5 Noise

Image noise is an unwanted condition where it is because fluctuation of pixel in an image, where mostly appeared in image regions with low signal level, such as shadow regions or underexposed images. Removing noise cannot be done without loss of some information in the image [4].

2.5.1 Types of image noise

i. In salt and pepper noise (also known as random noise or independent noise), pixels in the image are vastly different in color from their surrounding pixels. Generally this type of noise will only affect a small number of image pixels. When viewed, the image contains dark and white dots, hence the term salt and pepper noise. Typical sources include flecks of dust on the lens or inside the camera.

ii. In Gaussian noise (dependent noise), an amount of noise is added to every part of the picture. Each pixel in the image will be changed from its original value by a (usually) small amount [5].



(a) Salt and paper noise (b) Gaussian noise

Figure 2.1: Type of noise

2.6 Type of emergency light

2.6.1 Optical type

In optical type there is 3 type of light, where rotating light contain a single bulb around which a curved mirror is spun, creating a rotating beam of light, which appears to flash when viewed from a stationary position. Rotating lights often use a quartz-halogen or conventional incandescent bulb, though some rotating beacons are now made with LEDs rather than bulbs. The second type is strobe light, based on strobe lights similar to those used in flash photography. It produced a bright flash by ionizing and then discharging a large current through the gas. Others optical type is LED light, they can be programmed with a wider variety of flash patterns because of their ability to be switched directly by electronics, as opposed to discharging a capacitor through a gas-filled tub.

2.6.2 Mounting type

In mounting type is has verities of type, Roof-mounted single beacon is one of the type that is widely used before Light bar were introduce, Light bars that may contain fixed, rotating, strobe, or LED-based lights offering programmable flash patterns where the flash pattern can be control. Other than that Body work mounted is also one type the light where can be mounted on to the outside of the vehicle and these can be used to provide directional lighting in key areas, such as in front for clearing traffic, or to the rear for scene protection. Common places to mount such beacons include on or in the grill of the vehicle and on the front of the rear view mirrors, where they can gain maximum visibility, or as additional lighting such as on the side of the bonnet which helps increase the warning for oncoming traffic when pulling out of junctions. The last type is Interior type that be used in the interior of a vehicle, generally on the dashboard, visor area, or rear deck [6].

2.7 Threshold

Threshold is used to segment an image by setting all pixels whose intensity values are above a threshold to a foreground value and all the remaining pixels to a background value. Threshold is use change image to a binary state where the pixel is 1 and 0. Thresholding is the simplest method of image segmentation. Several different methods for choosing a threshold exist.

Fixed threshold

One alternative is to use a threshold that is chosen independently of the image data. If it is known that one is dealing with very high-contrast images where the objects are very dark and the background is homogeneous and very light, then a constant threshold of 128 on a scale of 0 to 255 might be sufficiently accurate. By accuracy we mean that the number of falsely-classified pixels should be kept to a minimum.

Istogram-derived thresholds

In most cases the threshold is chosen from the brightness histogram of the region or image that we wish to segment. A variety of techniques have been devised to automatically choose a threshold starting from the gray-value histogram, $\{h[b] \mid b = 0, 1, \ldots, 2^B-1\}$. Many of these algorithms can benefit from a smoothing of the raw histogram data to remove small fluctuations but the smoothing algorithm must not shift the peak positions. This translates into a zero-phase smoothing algorithm given below where typical values for W are 3 or 5:

$$h_{smooth}[b] = \frac{1}{W} \sum_{w=-(W-1)/2}^{(W-1)/2} h_{raw}[b-w] \qquad W \text{ odd}$$

Isodata algorithm

The histogram is initially segmented into two parts using a starting threshold value such as $\theta_0 = 2^{B-1}$, half the maximum dynamic range. The sample mean ($m_{f,0}$) of the gray values associated with the foreground pixels and the sample mean ($m_{b,0}$) of the gray values associated with the background pixels are computed. A new threshold value θ_1 is now computed as the average of these two sample means. The process is repeated, based upon the new threshold, until the threshold value does not change any more. In formula:

$$\theta_k = \left(m_{f,k-1} + m_{b,k-1}\right)/2 \;\; until \;\; \theta_k = \theta_{k-1}$$

Triangle algorithm

A line is constructed between the maximum of the histogram at brightness b_{max} and the lowest value b_{min} = (p=0) % in the image. The distance d between the line and the histogram $h[b]$ is computed for all values of b from $b = b_{min}$ to $b = b_{max}$. The brightness value b_o where the distance between $h[b_o]$ and the line is maximal is the threshold value, that is, $\theta = b_o$. This technique is particularly effective when the object pixels produce a weak peak in the histogram [7].

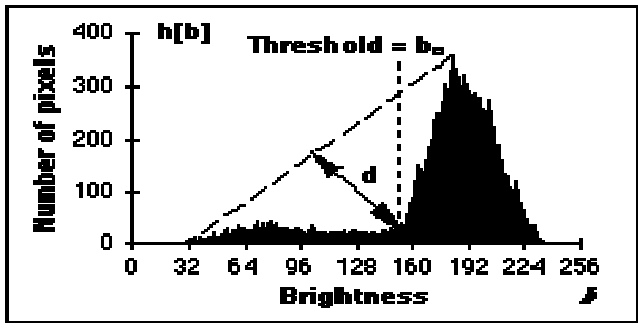


Figure 2.2: The triangle algorithm is based on finding the value of *b* that gives the maximum distance d.

CHAPTER 3

METHODOLOGY

3.1 Interfacing MIL with Visual Basic

Firstly the Visual Basic 6 software must be installed by following the instruction step. The important setting for this MIL installation show below:-

i. Development - Matrox imaging library, Active Mil and intelicam
ii. Hardware device - corono.II, VGA

Full version of MIL has no time limit where hardware like frame grabber or digitizer can be use to interface with MIL. For evaluation software, user can only use it for 30 day and after the duration MIL tools cannot be use anymore and the software must be uninstall. The command of MIL tool is use a Visual Basic language and the ActiveX will be automatically added to the Visual Basic. Installation of MIL must be after the Visual Basic has been installed because if not the ActiveX from MIL will not automatically add. MIL is also can be install at a Visual C++. After the installation Active MIL user guide can be locate at ActiveMIL help where all guided is provided.

3.2 Software structure

A graphical user interface (GUI) is an icon for a program, interaction between user and program is through GUI where all the programming writes in the GUI icon. Use of GUI application will help the beginner user to familiarize with a programming. Consistent GUI also enable user to learn new application faster. The control icon can be added by pointing and clicking the mouse where the icon will be appeared on the form, then the icon can be rearrange the placement by drag the icon in the toolbox. The basic function of toolbox is an important knowledge that needs to understand to develop software. There is a basic description of toolbox in table 3.1 where the control is used to develop the software structure in figure 3.1.

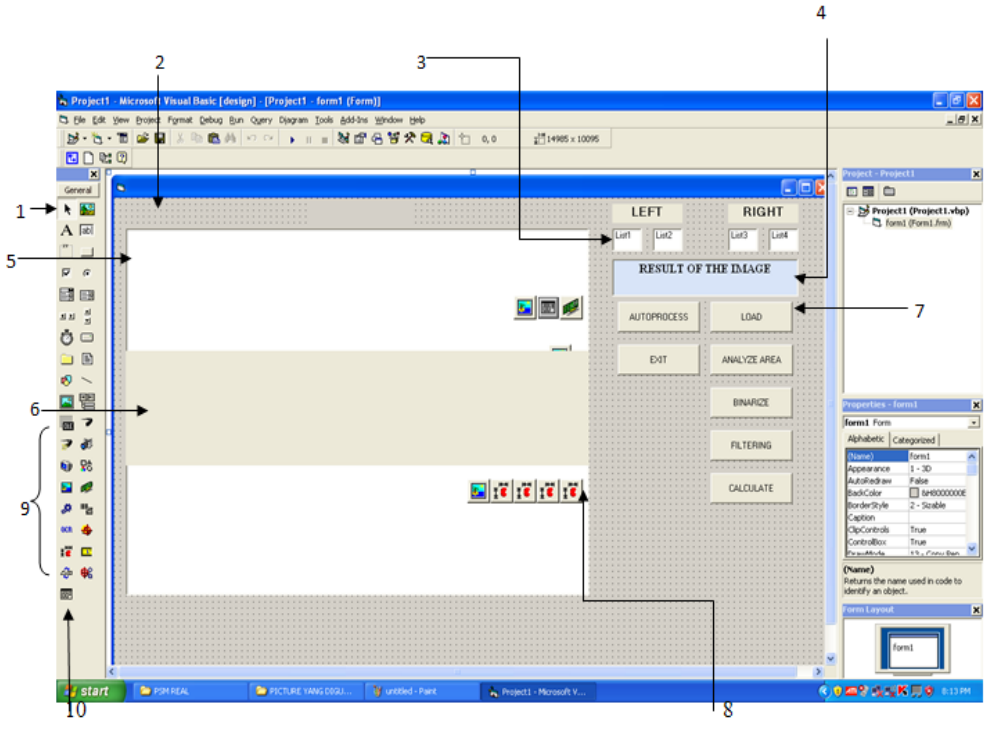


Figure 3.1: Software structure

Table 3.1: Control Description

No.	Control	Description
1	Toolbox	Contain control used to customize forms.
2	Form	Where the program's Graphical User Interface (GUI) will be displayed.
3	ListBox	A control that provide a list of items.
4	TextBox	A control for accepting user input. TextBox can only display text.
5	PictureBox	A control that display image.
6	Display	A control that display image from PictureBox.
7	CommandButton	A control that represents a button. The user presses or clicks to initiate an action.
8	Blob analysis control	A control that Identify connected regions of pixels within an image.
9	Matrox toolbox control	Contain control used to analyze image.
10	CommonDialog	Provide several common dialog boxes such as open and save.

3.3 GUI development

Visual Basic's Integrated Development Environment (IDE) allows the programmers to create and run window program in one application (Visual Basic) without need to open additional program. Where program to create and execute the program is in one application. When Visual Basic is loaded New Project dialog shown in table 3.2 is displayed. The New Project dialog allows the programmer to choose type of Visual Basic program to create. Standard EXE, which is highlighted by default, allow the programmer to create a standard executable. Software development in this project must be build by following step order. Firstly Standard EXE is selected and Open button is press.

Figure 3.2: New Project dialog

Figure 3.3 shows the IDE after Standard EXE is selected. A Standard EXE project contains following windows:

i. Project1-Form1 (Form)
ii. Form layout
iii. Properties – Form1
iv. Project – Project1
v. Toolbox

The Project1-Form1 contains a form that use to display a GUI. Control icon is a portion for program where the programming is written in the icon and the result were displayed on form. The form size must be resized by modify the height and width where the scale mode is in a pixel sized at the property form.

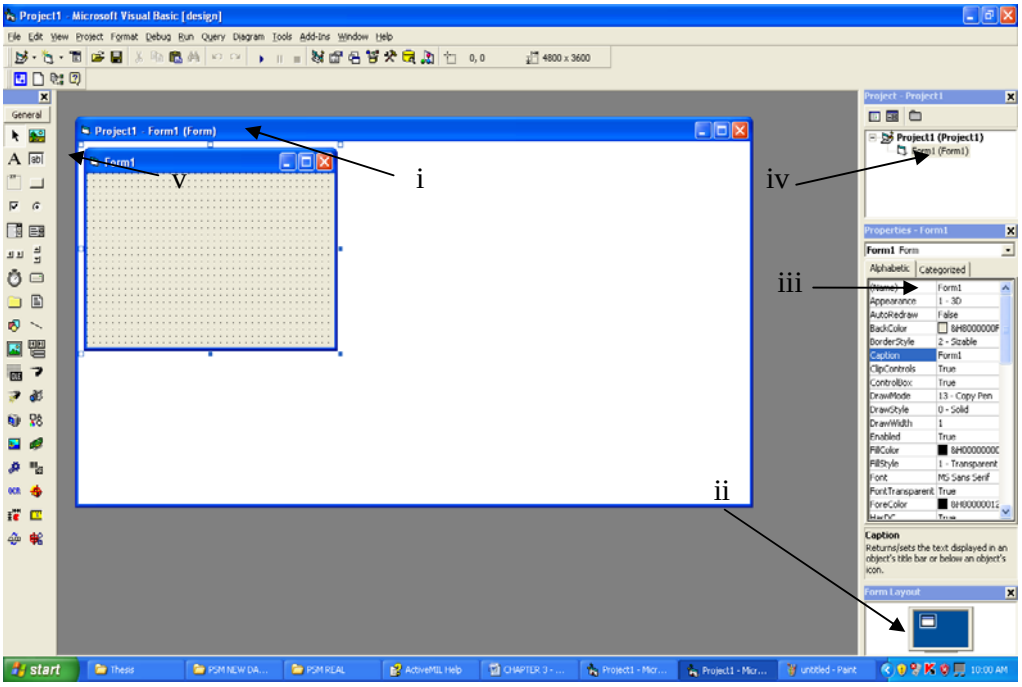
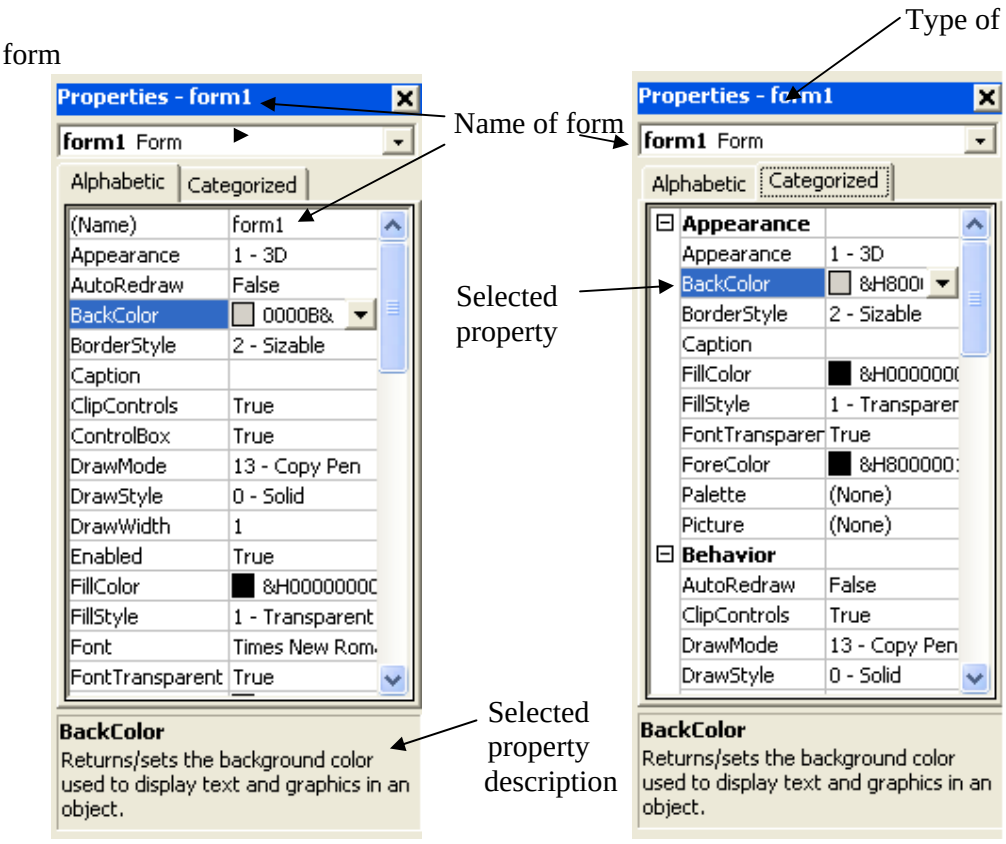


Figure 3.3: IDE with a Standard EXE project open

The properties window (Figure 3.4) shows the properties for a form or control. Properties are attributes such as appearance, back color, size and lot more. Properties are listed either alphabetic or categorized. Alphabetic is a default condition where list of properties can be scroll by using a scrollbar.



(a) (b)

Figure 3.4: Properties window with (a) alphabetic and (b) categorized tabs.

The Form layout window (Figure 3.5) shows a form position on the screen at run time. It is consist of an image representing the form relative position on the screen and screen. The form position on the run time can be change by drag the form image to the required position.

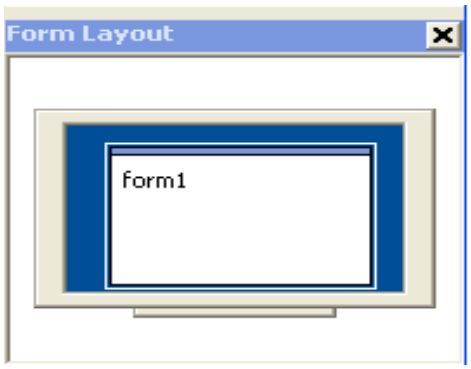


Figure 3.5: Form layout window

Visual Basis control exists in two varieties, intrinsic control and ActiveX control. Intrinsic control or called standard controls are the default control provided in the Visual Basic toolbox.

Secondly after the form has been resized ActiveX control must be loaded into the Visual Basic with the Components dialog (Figure 3.6). In this project some ActiveX control must be added to the toolbox by selected Components menu's in the Project menu. ActiveX control must be selected by pressing OK to load the control icon to the toolbox. There are list of ActiveX control component that added in this project.

i. ActiveMil Base Control
ii. ActiveMil Blob Analysis Control
iii. ActiveMil Image Processing Control
iv. Microsoft Common Dialog Control 6

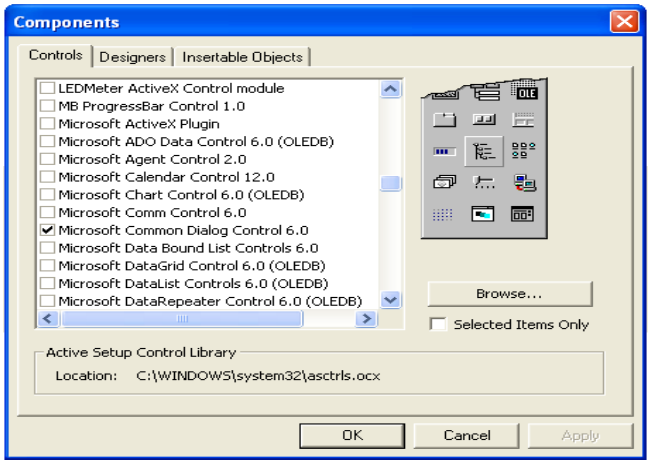


Figure 3.6: Component dialog

3.3.1 Picture Box

After the ActiveX control is added, the Picture Box control is added to the form by double clicking the Picture Box control and it will automatically added to the form1. The property setting is illustrated in table 3.5.

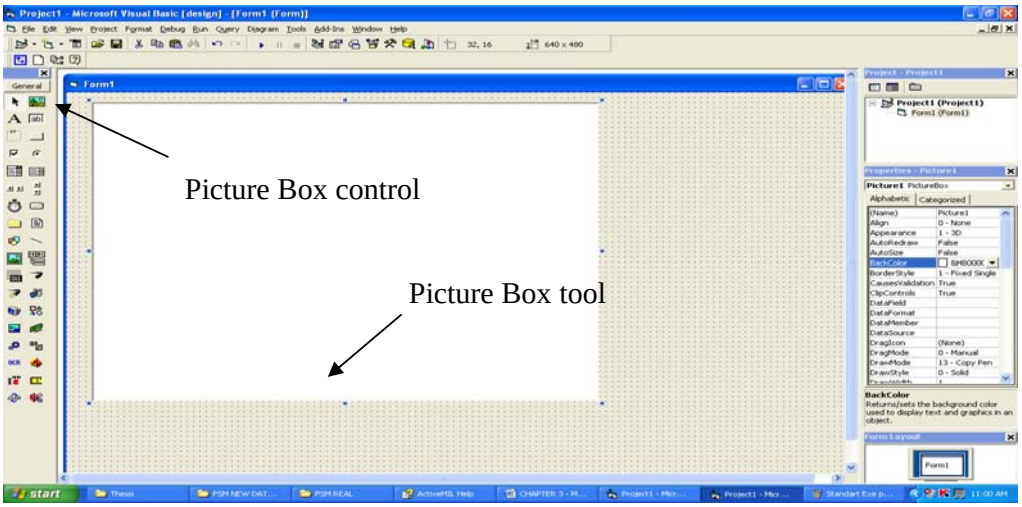


Figure 3.7: Load Picture Box into Form1

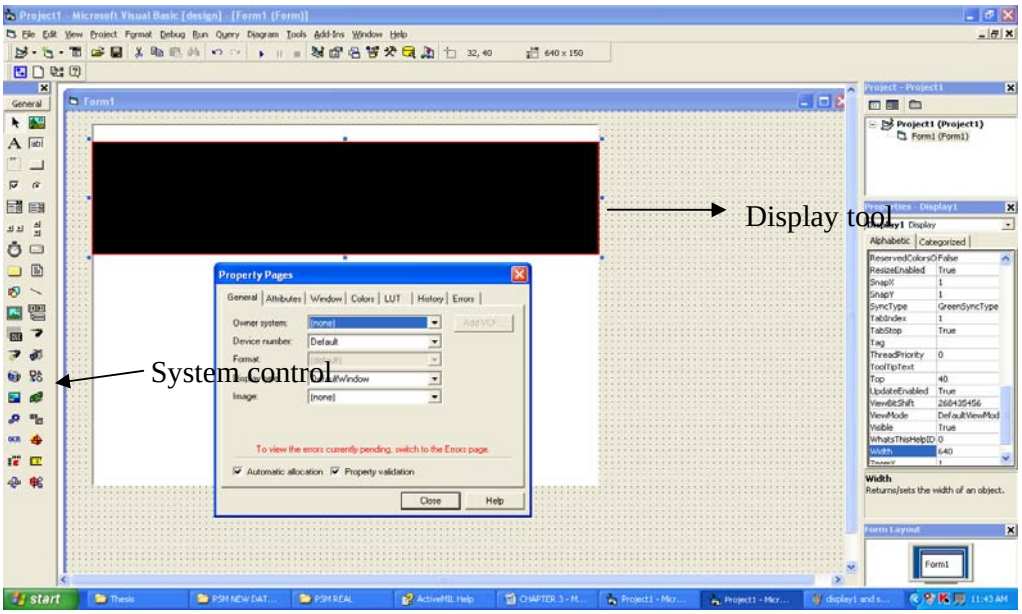


Figure 3.8: Load Display into Form1

3.3.2 Display and System

Third step is to added the display to the form, by double clicking the Display control it will inserted to the form where the property were shows at table 3.5. The ActiveX control must have a System to control the operation. If System control is not attach, the Display1 will surrounded by red line (Figure 3.8).The error can be solve by insert the System control and owner system property for Display1 has to be named by the System tool name (System1). System type that is use is VGA where it can be setting at system tool property.

3.3.3 Image control

The Image control is use to stored image that has been process where the programming is written in the command button. Figure 3.9 show an image tool that has been inserted by double clicking the control icon. Image property (Figure 3.10) is important to setting the analyzed image, parent image is an image that use as a reference for the child image. Size of image need to be specified to get a full size of the image and child image can crop the image by setting the child region by calculate distance of pixel image using thus formula below. Band is a number of components in the image and for a grayscale image band is one and three for a color image because it has red, green, blue component in the image. Image properties of the project were described in the figure 3.2.

Child region calculation

i. Size(X, Y) = (X =Xmax – Xmin ,Y=Ymax –Ymin)
ii. Offset (X, Y) = (X=Xmin, Y=Ymin)

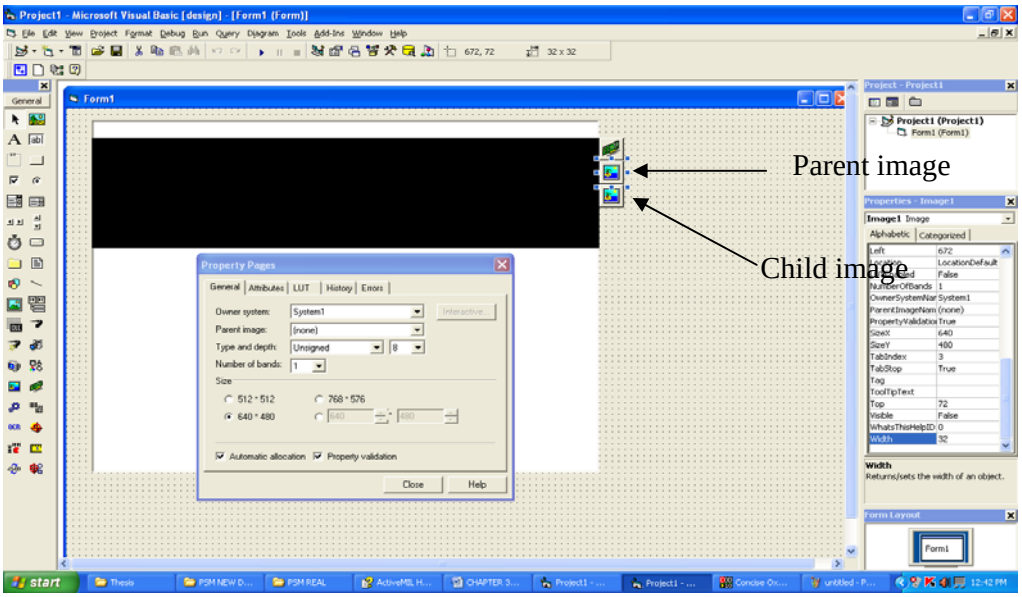
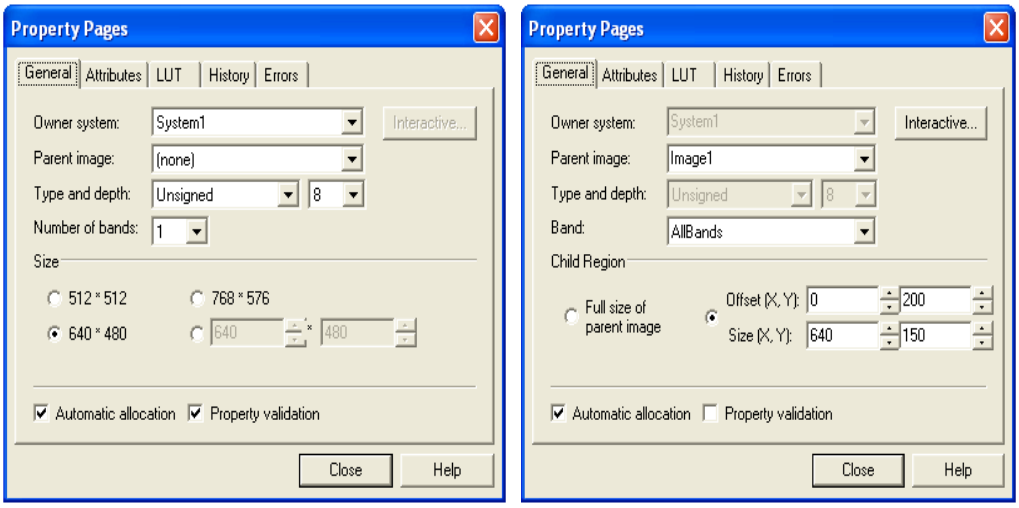


Figure 3.9: Image control property

Table 3.2: Image property

Image Name	Parent Image	Child region (pixel)			
		size		Offset	
		X	Y	X	Y
Image1	-	640	480	0	0
Image2	Image1	640	150	0	200
Image3	Image2	Full size of parent image			
Image4	Image3	Full size of parent image			



(a) (b)

Figure 3.10: Property of image (a) Parent Image and (b) Child Image

3.3.4 Command Button

A Command Button (Figure 3.11) is create in this form is operated in two order, manually and automatically. Manual operation is use to illustrate how the software operate and the automatic operation demonstrate the full operation by just load the picture and result of analyze image is displayed. In each common button have own programming command and property of Command Button is illustrate in table 3.5. Command Button dialog tool is needed to open and save file. Figure 3.12 shows an example of load command.